

The aedine subgenus *Neomelaniconion* Newstead
(Culicidae, Diptera) in southern Africa with
descriptions of two new species*

by

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Aedes (*Neomelaniconion*) *unidentatus* spec. nov. and *A.* (*N.*) *luridus* spec. nov.
are described. Keys are given to the subgenera of *Aedes* and to the eight
South African species in the subgenus *Neomelaniconion*, which are reviewed.

During collections of mosquitoes in March 1969 at Bethulie in the Orange Free State an undescribed form of *Neomelaniconion* was found in very large numbers occurring together with *Aedes lineatopennis* (Ludlow). The new form possesses armed hind claws, and on this character alone seemed quite distinct from *lineatopennis*, which has simple hind claws. Study of pinned specimens of the subgenus from various localities in southern Africa† revealed a second undescribed form, also possessing armed hind claws but otherwise very similar to *lineatopennis*. Collections in the field showed that the second form also occurred sympatrically with *lineatopennis*. Study of adult specimens reared from isolated females collected at localities where *lineatopennis* co-existed with either one or the other form indicated that both undescribed forms were specifically distinct.

A taxonomic study of all available material of the subgenus in southern Africa was made to identify characters useful in specific differentiation and to determine the geographical distribution of the species. Specimens from the following collections were examined: (a) all those of the subgenus at the South African Institute for Medical Research, Johannesburg and the Brigada de Erradicacao do Paludismo, Lourenço Marques; (b) all Ethiopian *lineatopennis* material at the British Museum (Natural History); (c) certain specimens of *lineatopennis* from the Philippines at the United States National Museum.

Neomelaniconion at present consists of 21 species, of which all except one are endemic to Africa south of the Sahara. Edwards (1941) divided the species in Africa (as subgenus *Banksinella*) into a group of the open savannah with banded terga in the female, of which *lineatopennis* was a member, and a group from forest with unbanded terga. This grouping is also meaningful with regard to males, as the species with banded terga also show close relationship on male genitalia.

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† Africa south of the Zambesi and Cunene Rivers.

The present fauna of southern Africa comprises the eight species listed below. The last two should only be included tentatively until their occurrence can be confirmed by the collection of further material. *Aedes palpalis* (Newstead) is the only representative of the group with unbanded terga.

<i>Aedes</i> (<i>Neomelanicion</i>)	<i>lineatopennis</i>	(Ludlow)
"	"	<i>unidentatus</i> spec. nov.
"	"	<i>circumluteolus</i> (Theobald)
"	"	<i>luridus</i> spec. nov.
"	"	<i>luteolateralis</i> (Theobald)
"	"	<i>aurovenatus</i> Worth
"	"	<i>albothorax</i> (Theobald)
"	"	<i>palpalis</i> (Newstead)

In these species the adult female provides the most reliable means for specific differentiation. The female characters concerned, in order of usefulness, are: (a) pale scaling of the wing veins, (b) hind tarsal claws, (c) colour of the pale scales of the vertex and scutum, (d) shape and colour of subspiracular scales and (e) degree of development of the pleural scale patches. The male of *aurovenatus* is unknown, and of the other species only *palpalis* possesses distinctive male genitalia. It seems that only the peg-like setae on the inner aspect of the gonocoxite have any taxonomic value among the remaining six species, which are best separated in the male on the colour of the vertex and scutum and hind tarsal claws as, because of the scanty scaling, the wing pattern is usually of little value in the male.

All species, except *aurovenatus*, show a distinctive longitudinal stripe along the lateral border of the scutum. The colour of the scales of this stripe, which match those of the vertex in each species, is apparently subject to fading in some individuals, probably as a result of ageing in nature. This is unfortunate, as the colour of these scales is an important specific character and is useful when identifying large numbers of mosquitoes.

The larvae and pupae of all the species have not been fully studied by me although quite detailed study of the larvae of *unidentatus* and *luridus* failed to reveal reliable specific characters to differentiate them from either *lineatopennis* or *circumluteolus*, which are themselves probably inseparable. The number of branches of head setae 5 and 6 in the larva showed interspecific differences as is evident from the data given below, but these may not remain constant among different geographical populations of the same species. This character would appear, however, to possess some practical value in separating certain species.

Though the distribution of species in southern Africa is still poorly known there are indications of distinct distributional differences correlating with climatic conditions. *A. lineatopennis* is exceptional in that it is widely distributed and includes within its range areas of markedly different climates. Several species occur in exceedingly large numbers, feed on man and domestic animals and have also been firmly implicated as vectors of arboviruses. Because of the seasonal nature of their appearance, however, these species could hardly maintain viral transmission over long periods and their role therefore is probably limited to that of incidental vector.

In the following account all previously determined species except one are redescribed. The reason for this is that the redescriptions refer specifically to material from southern Africa and previous descriptions are inadequate in that insufficient emphasis has been given to key characters.

Since the females of all species in southern Africa possess a lower mesepimeral seta and have either armed or simple hind claws, the keys for the identification of aedine subgenera given by Edwards (1941) and Le Berre & Hamon (1960) require amendment.

Key to the subgenera of *Aedes*

FEMALES

- 1 Base of M3+4 wing vein distal to radiomedial crossvein and membrane adjoining these veins with blackish clouding; mouldy appearance due to erect scales on body and legs **Mucidus**
- Base of M3+4 wing vein proximal to radiomedial crossvein and unclouded; not mouldy **2**
- 2 One or more lower mesepimeral setae **3**
- These setae absent **Finlaya, Aedimorphus, Stegomyia** (in part), **Ochlerotatus** (in part)
- 3 Paratergite bare, or almost always bare **4**
- Paratergite scaly **Pseudarmigeres, Diceromyia, Ochlerotatus** (in part)
- 4 Hind tibia with white median ring **Stegomyia** (in part)
- Hind tibia without this ring **5**
- 5 Decumbent scales of vertex narrow; sometimes a broad band of yellow or whitish scales along lateral border of scutum **Neomelaniconion**
- Decumbent scales of vertex broad; scutum without this band **Skusea**

Key to species of *Neomelaniconion*

FEMALES

- 1 Terga banded basally **2**
- Terga without basal pale bands **palpalis**
- 2 Radial wing vein yellow almost to apex of R1 **3**
- This vein pale on basal 1/3 or 2/3 only **4**
- 3 Wing veins R4+5 and anal yellow scaled; scutum uniformly covered with yellow scales; hind unguis simple **aurovenatus**
- Wing veins R4+5 and anal almost or entirely dark; scutum with distinct, yellow lateral bands; hind unguis armed **luteolateralis**
- 4 Vertex and lateral border of scutum greyish white; postspiracular scales absent **albothorax**
- Vertex and lateral border of scutum yellow; postspiracular sometimes present **5**
- 5 Hind unguis armed **6**
- Hind unguis simple **7**
- 6 Lateral band on scutum pale yellow; large postspiracular scale patch; subcosta pale; radial vein pale to base of radial sector **luridus**
- Lateral scutal band bright golden yellow; postspiraculars small or absent; subcosta dark; radial vein pale to beyond base of radial sector **unindentatus**
- 7 Lateral band on scutum bright, golden yellow; plume scales on radial sector, R2+3, stem of media and M1+2 largely pale; subspiracular scales yellow and narrow **lineatopennis**
- Lateral scutal band pale yellow; plume scales on radial sector, R2+3, stem of media and M1+2 largely dark; subspiraculars creamy and broad **circumluteolus**

MALES (*aurovenatus* omitted)

- 1 Gonostylus with large clump of setae on distal third surrounding gonostylar claw **palpalis**
- Gonostylus without these setae **2**
- 2 Pale scales of scutum white; gonocoxite deeply concave on inner margin just beyond middle; very few peg-like setae on gonocoxite **albothorax**
- Pale scales of scutum yellow **3**
- 3 Gonocoxite with few peg-like setae ($\pm 3-10$); hind unguis simple **lineatopennis**
- Gonocoxite with dense clump of peg-like setae; hind unguis sometimes armed **4**
- 4 Hind unguis simple **circumluteolus**
- Hind unguis armed **5**
- 5 Pale scales of scutum golden yellow **6**
- Pale scales of scutum pale yellow **luridus**
- 6 Palpus not much longer than proboscis **luteolateralis**
- Palpus exceeding proboscis by almost whole length of terminal segment **unidentatus**

Differentiation of larvae by means of number of branches of head setae 5 and 6 (*albothorax*, *palpalis* and *aurovenatus* omitted)

Species	Locality	Seta 5		Seta 6	
		Usual	Range	Usual	Range
luridus	Bethulie	3-4		3	3-4
lineatopennis	Philippines	6	5-8	5	
"	Newington	4-6		3-4	3-5
"	Rhodesia	5-6	4-7	4-5	4-6
"	Bethulie	4-5		3-4	
unindentatus	Johannesburg	5	6-8	4-5	
circumluteolus	Ndumu	6-8	5-8	5-7	
luteolateralis	St. Lucia	6-7		10	

Aedes lineatopennis (Ludlow), figs. 1, 6

Taeniorhynchus lineatopennis Ludlow, 1905, *Canad. Ent.* **37**: 133.

Banksinella lineatopennis Edwards, 1915, *Bull. ent. Res.* **5**: 274.

Banksinella luteolateralis Theobald, 1907, *Mon. Cul.* **4**: 469 and 1910, *Mon. Cul.* **5**: 403.

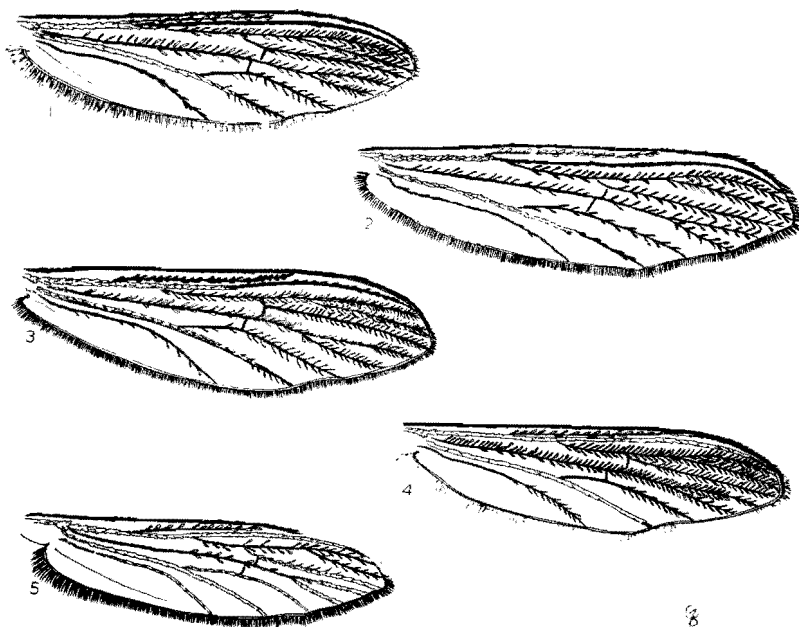
Aedes lineatopennis: Edwards 1941, *Mosq. Ethiopian Region*, **3**: 202. Knight & Hull, 1953, *Pacific Sci.* **7**: 469 (designation of lectotype). Stone & Knight, 1956, *J. Washington Ac. Sci.* **46**: 220 (locality of lectotype).

This is a species with dark thoracic integument, bright golden-yellow scales on the vertex and lateral scutal band, and simple hind claws. The pleural scale patches are poorly developed and the subspiracular patches consist of narrow, yellow scales. It is likely to be confused with *unidentatus*, from which species it can be separated, however, by the simple hind ungues.

FEMALE. Head: scales of central part of vertex bright golden-yellow, decumbent ones narrow, projected forward between eyes as prominent frontal tuft; large patches of broad, black, decumbent scales laterally, divided by narrow stripe of pale scales; erect scales on occiput broad, golden medially, black laterally; proboscis dark; palpus dark, about 0.2 length of proboscis. **Thorax**: integument dark brown to black, though palish on caudal sclerites of pleuron; a broad longitudinal band along lateral border of scutum with bright golden-yellow scales; similar scales along anterior border of scutum and around prescutellar bare space; central part of scutum with dark brown to black scales, sometimes with narrow submedian yellow line extending forward from prescutellar bare space; dorsocentral and acrostichal setae present, latter poorly developed; scutellum lightly sprinkled with narrow yellow scales; pleural scale patches poorly developed; postspiracular scales usually absent, but rarely a small patch of narrow yellow scales; subspiraculars consisting of two smallish patches of narrow yellow scales; small to medium patches of broad creamy-white scales, on upper and lower mesepisternum; mesepimeron with small patch of similar scales just below upper mesepimeral setae; antepronotum largely bare of scales; postpronotum lightly sprinkled with dark scales, a few pale ones caudally; propleuron with creamy scales; one to three lower mesepimeral setae present. **Abdomen**: terga dark, with basal pale bands extending caudally about one-quarter of segment, not quite reaching lateral pale spot and narrowing laterally on distal segments; narrow pale apical line sometimes present on distal terga; small, basal and apical pale patches laterally on most terga; sterna largely

dark but usually with some pale scales basally and apically along sides. *Legs*: largely dark; anterior surface of hind femur largely pale on basal half, pale scaling sometimes extending near to apex towards lower margin; hind tibia rarely with pale, longitudinal line along ventral margin; femora and tibiae extensively pale posteriorly with pale scales extending on to tarsomere 1 of midleg; fore and midtarsal unguis equal, each unguis unidentate; hind unguis equal, simple. *Wings*: (fig. 1) dark, with creamy white scaling as follows: subcosta almost entirely; squame scales from base of radial stem to base of radial sector; plume scales on radial sector, R2+3, stem of media and M1+2; forks variably pale but plume scales usually pale on basal fifth of R2 and basal halves of R3 and M1; squame scales on cubitus from base to halfway between its junction with medio-cubital crossvein and wing margin. *Wing*: 3,4-3,8 mm. Proboscis 2,0 mm.

MALE. Essentially as in female; shaft of palpus just shorter than proboscis; only one segment distal to shaft; dense row of long setae on about distal quarter of shaft projecting ventro-laterally; second segment of palpus with similar row of setae medially and another laterally; lower mesepimeral seta absent; pale scaling of terga reduced to small, mediobasal bands; tarsal unguis of fore and midlegs unequal, armed, of hind legs equal, simple. *Genitalia*: (fig. 6) relatively few peg-like setae along tergo-mesal margin of gonocoxite and usually absent distal to insertion of gonostylus. Proboscis 1,8 mm. Palpal shaft 1,6 mm. Palpal 2nd segment 0,88 mm.



Figs 1-5. Wings of *Neomelaniconion* species, with localities. 1. *Aedes lineatopennis* (Ludlow); Newington. 2. *A. circumluteolus* (Theobald); Ndumu. 3. *A. unidentatus* spec. nov.; Olifantsvlei. 4. *A. luteolateralis* (Theobald); St. Lucia. 5. *A. aurovenatus* Worth (paratype); Ndumu.

LARVA. No clear-cut differences noted from Hopkins' (1952) description of *circumluteolus*, although head setae 5 and 6 seem, on the average, to have fewer branches than the latter species.

TAXONOMIC DISCUSSION. Dr Botha de Meillon (Project Director South East Asia Mosquito Project, Washington,) examined specimens from Asia in the United States National Museum and advised me that though the lectotype has both hind legs missing another female bearing the same Museum number as the type has one leg intact on which each unguis is simple. Simple hind unguis were also present on specimens from six localities in Luzon, Philippines, and also from Malaysia, Java and Thailand. Knight & Hull (1953) also describe *lineatopennis* from Asia as having simple hind unguis.

There is some morphological variation in specimens that I have seen from different localities in Africa. The above description refers to a large series bred out from females collected at Newington, in the eastern Transvaal lowveld of South Africa. Morphologically similar specimens have been seen from the coastal lowlands of Natal and Moçambique. Seven females and two males bred out from three females collected at Bethulie, South Africa, have the sterna almost entirely pale. A large series, including several reared specimens, from three localities near Salisbury, Rhodesia, shows the subcosta sometimes largely dark, about 10 percent of either sex with a single unguis of one hind leg armed and the peg-like setae of the male sidepiece exceptionally numerous. Among material received from the British Museum 22 specimens were identified as *lineatopennis* from localities in Africa extra-limital to southern Africa as listed below. Among these all specimens with hind tarsi still intact had simple hind unguis. In some specimens from the Sudan and Angola the subcosta was largely dark, and in others from Ethiopia and Angola the subspiracular scales were broadish. It is apparent that within Africa *lineatopennis* as here defined is subject to significant variation. For the present it seems advisable to regard this as geographical variation. Specimens that I have seen from the Philippines have fewer pale scales on the radial sector and media, radius tends to be pale slightly beyond base of radial sector, and the pleurae are almost devoid of scales (rubbed ?).

In Edwards' (1941) description of *Aedes bolensis* Edwards, at which time only the holotype male was known, he was undecided whether this form was merely a variant of *lineatopennis*. This is not so, as Dr P. F. Mattingly (British Museum) examined the hind unguis of the holotype and found them to be armed, and furthermore, from the description of a large series consisting of both sexes by Hamon & Rickenbach (1954) it is clear that the scutum of *bolensis* is markedly different.

TYPE DATA. Lectotype female, Philippines, Camp Gregg, Luzon. Selected by Knight & Hull, 1953. United States National Museum.

DISTRIBUTION. Material was examined from the following localities. SOUTH AFRICA: *Transvaal*; Lake Chrissie (1700 m), Nylstroom (1143 m), Pienaars' River (1200 m), Newington (300 m), Pongola (274 m). *Natal*; Durban (sea level), Mtunzini (20 m), Ndumu (30 m), Bergville (1000 m), Port Shepstone (sea level). *Orange Free State*; Bethulie (1274 m), Kroonstad (1427 m), Odendaalsrus (1400 m). SOUTH WEST AFRICA: Runtu (1311 m), Okakarra. BOTSWANA: Kasane (914 m). MOÇAMBIQUE: Moamba (lowland). RHODESIA: Marodzi, Nyabira, Lake McIlwaine, Pearson, Gwebi, Salisbury (all about 1700 m). **Extra-limital**: ZAMBIA: Livingstone (1 ♂). ANGOLA: Bihe (2 ♀), locality unknown (1 ♀). CONGO: Lumbum-

bashi (Elizabethville) (4 ♀). NIGERIA: Gadan (1 ♀), Bomo (1 ♀). TANZANIA: Njombe (1 ♀). KENYA: Nairobi (1 ♀). ETHIOPIA: Bahr Dar (4 ♀). SUDAN: Njara (6 ♀). PHILLIPINE ISLANDS: Sison (1 ♀, 1 ♂, 3 larvae), Balian, Laguna (2 ♀, 2 ♂, 4 larvae).

BIONOMICS AND DISEASE RELATIONSHIPS. A widely distributed species, apparently adapted to regions with markedly different climates, although probably dominated by *circumluteolus* in the eastern, coastal lowlands of Natal and Moçambique and by *unidentatus* and *luridus* on the highveld and Karroo respectively. *Aedes lineatopennis* was the only species collected by me at Newington and on the Rhodesian highlands, where it was plentiful. From this it seems that in southern Africa it is best adapted to regions of intermediate temperature. It bites man and the larger domestic animals readily.

Two strains of Rift Valley fever virus, 17 of Wesselsbron and two of Middelburg were isolated from this species from collections made in May 1969 during an extensive epizootic of Rift Valley fever in cattle in Rhodesia, and it seemed that this species was the main vector of Rift Valley fever virus during this outbreak. In laboratory tests this species was readily infected by this virus when fed on viraemic animals, but transmission tests were not possible due to a failure to induce them to feed a second time.

***Aedes unidentatus* spec. nov., figs. 3, 9**

A large species very similar to *lineatopennis* with a dark thoracic integument and bright golden-yellow scales on the vertex and lateral scutal band. It can be separated from that species in the female by the dark subcosta, the greater amount of pale scaling on the radius and the unidentate hind claws.

FEMALE. *Head:* pale scales of vertex bright, golden yellow; proboscis and palpus dark; palpus 0.2 length of proboscis. *Thorax:* scales of lateral scutal band a bright golden yellow; pleural scale patches slightly more developed than *lineatopennis*, with a small postspiracular patch usually present and mesepisternal and mesepimeral patches each consisting of 15–25 scales; subspiraculars consisting usually of only one patch of yellowish and narrow scales. *Abdomen:* terga with prominent basal pale bands even on the more distal segments; large, basal and apical patches laterally, or these joined to form a broad band along entire length of tergum; terga 5–7 sometimes with narrow, pale apical line. *Legs:* hind tibia sometimes with pale apical spot; unguis of hind leg unidentate. *Wings:* (fig. 3) dark, like *lineatopennis*, with the following differences: subcosta dark; radius pale to beyond base of radial sector, sometimes as far as base of R4+5 with pale line tending to be broken distally; vein R2 usually pale on basal two-thirds; cubitus usually pale to beyond halfway between mediocubital crossvein and wing margin. Wing 4.0–4.6 mm. Proboscis 2.2 mm. Forefemur 1.8 mm.

MALE. Essentially like female. Second segment and apical third of shaft of palpus densely hairy; postspiracular scales absent; subspiracular scales absent or reduced; lower mesepimeral seta absent; terga dark except for poorly developed basal bands; hind unguis unidentate. *Genitalia:* (fig. 9) a dense row of peg-like setae rather like *circumluteolus*. Proboscis 2.2 mm. Palpal shaft 2.1 mm.

LARVA AND PUPA. Very similar to *lineatopennis*; head setae 5 and 6 of larva usually with 5 and 4–5 branches respectively.

A large series of males, females, larvae and pupae was reared from 11 females collected at Olifantsvlei, near Johannesburg. In addition, hundreds of wild-caught females from this locality have been checked for the presence of armed hind unguis. At Lake Chrissie it was found co-existing with *lineatopennis* on the same farm, Vredelus, but in slightly greater numbers than that species. Adults, the progeny of several isolated females of both species collected at this locality, showed hind unguis similar to the parent in each instance.

TYPE DATA. Holotype ♀, reared from female ex Olifantsvlei, Johannesburg, SOUTH AFRICA. Allotype ♂, with mounted genitalia, reared from same female as holotype. Paratypes. 8 ♀, 1 ♂, reared either from same female as holotype or other females with same field data. The holotype, allotype and 5 paratypes at the South African Institute for Medical Research, Johannesburg; two ♀ paratypes each, deposited at United States National Museum and British Museum (Natural History).

DISTRIBUTION. Material was examined from the following localities. SOUTH AFRICA: *Transvaal*; Olifantsvlei, Johannesburg (1750 m), Bapsfontein (1750 m), Lake Chrissie (1698 m). *Orange Free State*; Harrismith (1628), Vaal River (locality unknown), Luckhoff (1280 m). LESOTHO: Leribe (1737 m).

BIONOMICS. Feeds voraciously on man and sheep, with its peak of biting commencing about half-an-hour after sunset. It is probably more common in the moister eastern part of the highveld and the middle veld part of the Orange Free State, where it is probably the numerically dominant species of the subgenus. At Olifantsvlei it has been found breeding in temporary rainwater pools, in open grassland in marshy ground. It seems likely that it was largely this species which was referred to as *lineatopennis* by McIntosh *et al.* (1967) and Jupp & McIntosh (1967). Quite large numbers have been collected at Olifantsvlei and tested for virus with negative results.

Aedes circumluteolus (Theobald), figs. 2, 8

Banksinella luteolateralis var ***circumluteola*** Theobald, 1908, *Entomologist*, **41**: 107.

Aedes circumluteolus: Edwards, 1941, *Mosq. Ethiop. Reg.* **3**: 204.

A much paler species than *lineatopennis*, from which it can be separated by the characters mentioned below. The simple hind unguis will separate this species from *luridus*, which has a similar pale yellow vertex and lateral scutal band.

FEMALE. Similar to *lineatopennis* with the following differences. Scales of vertex pale yellow; proboscis sometimes pale below in middle. *Thorax*: integument pale brown to yellowish; yellow scales of scutum of the same pale shade as those of vertex; scale patches on mesepisternum and mesepimeron well developed, each usually consisting of 30–40 scales; subspiracular scales broad, creamy white. *Abdomen*: basal bands slightly more prominent on distal segments; pale apical line on distal segments more rarely present; sterna largely pale. *Legs*: hind tibia frequently pale below along its entire length. *Wings*: (fig. 2) plume scales on radial sector, R2+3, stem of media and M1+2 dark, sometimes with a few scattered pale scales; forks also usually much darker.

MALE. With pale vertex and scutal stripe like female. Peg-like setae of gonocoxite more numerous and usually extending distal to insertion of gonostylus (fig. 8).

Little difficulty should be encountered in separating females from those of *lineatopennis* in southern Africa on the basis of the darker wing veins and the paler vertex and scutal band. The broad whitish subspiracular scales and well-developed mesepisternal and mesepimeral scale patches and pale sterna are useful subsidiary characters.

DISTRIBUTION. Material was examined from the following localities. BOTSWANA: Kasane (914 m). MOÇAMBIQUE: Lourenço Marques, Macia (lowlands). SOUTH AFRICA: Natal; St. Lucia, Hluhluwe, Tete Pan, Ndumu (coastal plain), Gwalaweni Forest (600 m). Listed in the Cuthbertson Collection from Salisbury, RHODESIA. Reported by Edwards (1941) from Durban and Ntambanana (near Empangeni) in Natal. **Extra-limital:**—Specimens seen from ZAMBIA: Livingstone. SUDAN: Nassir Sobah.

TYPE DATA. ♀, *Banksinella luteolateralis* variety. Locality; Transvaal, SOUTH AFRICA. British Museum (Natural History).

BIONOMICS AND DISEASE RELATIONSHIPS. This is apparently the predominant member of the subgenus in the tropical coastal lowlands from northern Natal northwards into Moçambique. In Tongaland in northern Natal it is probably one of the most prevalent of all mosquitoes during the summer (de Meillon *et al.*, 1957; Worth *et al.*, 1960). In this region the adults are found concentrated in vast numbers on the flood plains of the Usutu and Pongola Rivers wherever the bush is dense enough to provide shade and humidity, either in savannah or in riverine forest. Despite the large numbers of adults encountered, larvae are difficult to find, and it seems that the adults might disperse some distance from breeding to resting sites. At Ndumu I have found larvae only on the flood plain. The eggs are presumably resistant to desiccation, and larvae were found amongst vegetation on the edges of large pans recently inundated from flooding of the above-mentioned rivers. Depending upon availability the main hosts at Ndumu are large domestic animals or antelope. It rarely feeds on birds or at the higher horizontal levels. Its feeding peak occurs during the early hours of darkness and it rarely feeds on man during daylight, particularly if stationary, but feeds readily on man in bush at night.

Eighty-eight strains of eleven different types of arboviruses have been isolated from *circumluteolus* collected in Tongaland, thus showing this species to be the most frequently infected mosquito in the area. Experimentally it has been shown able to transmit Wesselsbron (Muspratt *et al.*, 1957), Spondweni, Bunyamwera and Middelburg viruses though tests with chikungunya (McIntosh & Jupp, 1970) and Rift Valley fever viruses indicated that it is unable to transmit the latter two viruses. It seems certain that in the eastern coastal lowlands of southern Africa it is an important vector of viruses, although it may not be able to maintain continuity of transmission since towards the end of the dry season in Tongaland adult populations fall to extremely low levels.

***Aedes luridus* spec. nov., fig. 7.**

A large scaly pale yellow species rather similar to *circumluteolus*, from which it can be separated by the larger postspiracular scale patch, the paler wing veins, and the unidentate hind unguis.

FEMALE. *Head:* scales of vertex pale yellow. *Thorax:* scales of lateral scutal band pale yellow (sometimes almost white in aged specimens); similar scales along

anterior border and a large patch in prescutellar area sometimes almost obliterating bare space; pleurae with very well-developed patches of pale yellow scales; postspiracular area with 10–30 narrow scales; subspiracular scales intermediate in width between those of *lineatopennis* and *circumluteolus*; upper and lower mesepisternal patches large and usually contiguous; mesepimeral patch large, occupying upper half of sclerite; scales on antepnotum and postpronotum numerous, largely pale. *Abdomen*: terga with prominent basal bands extending caudally to about one-third length of segment; distal segments with definite but narrow apical pale band tending to join lateral pale area; terga 6 and 7 sometimes almost entirely pale; on remaining terga a prominent rectangular pale area laterally extending whole length of most segments; sterna largely pale. *Legs*: fore and midfemora slightly pale towards base, especially along margins; hind femur largely pale on basal half, extending towards apex below; hind tibia usually with longitudinal, continuous or broken, pale line; femora, tibiae and first tarsomere extensively pale behind; tarsal unguis of all legs equal and unidentate. *Wings*: very similar to *lineatopennis*, though R2 and R3 slightly darker and often a small pale spot present at base of anal vein. Wing 4.0 mm. Proboscis 2.0 mm.

MALE. Similar to female. Central scutum paler hence lateral pale stripe less distinct; fewer scales on pleuron and postspiracular scales sometimes absent; terga dark except for reduced basal bands; hind tibia usually without pale line; genitalia (fig. 7) very similar to *circumluteolus*. Proboscis 2.0 mm. Palpal shaft 1.7 mm. Second palpal segment 0.8–1.0 mm.

LARVA AND PUPA. Very similar to *lineatopennis*. Larva with head setae 5, 3–4 branched and 6, 3 rarely 4 branched.

MATERIAL EXAMINED. SOUTH AFRICA: *Orange Free State*; 26 ♀, 10 ♂, 6 male terminalia, 11 larvae and 8 pupal pelts, all reared from females plus large numbers wild-caught females from Bethulie (1274 m); 2 ♀, Luckhoff (1280 m).

TYPE DATA. Holotype. ♀, reared from female collected 3 miles west of Bethulie, SOUTH AFRICA. Allotype. ♂, with mounted genitalia, reared from same female as holotype. Paratypes. 7 ♀, 1 ♂, reared from females with same field data as holotype. Holotype, allotype, 4 paratypes held at South African Institute for Medical Research, Johannesburg. Two ♀ paratypes each, deposited at United States National Museum and British Museum (Natural History).

BIONOMICS AND DISEASE RELATIONSHIPS. Extremely large numbers were collected biting man about sunset and in light traps in open Karroo-type vegetation at the type locality near Bethulie when visited during March 1969. Adults of both sexes, including a high proportion of blooded females, were resting in rank grass in and around a recently flooded pan. Although there were no sheep nearer to this pan than 2 or 3 miles, precipitin tests on blood-meals of 16 mosquitoes collected at the pan were positive for sheep. It seemed that the females regularly travelled these distances to feed and then returned to the pan. Specimens of *lineatopennis* were also collected at the same time but in much fewer numbers, and it seems likely that *luridus* is the dominant species of the group in the arid Karroo region of South Africa. Its appearance in large numbers was irregular, as none or very few of this species were collected during other visits to Bethulie.

About 2000 of this species, collected near Bethulie, were tested for virus with negative results. Multiple isolations of Wesselsbron and Middelburg viruses reported by Kokernot *et al.* (1957, 1960) as originating partly from a species related to or identical

with *albothorax* may have, in fact, been from *luridus*. The extremely pale scutal bands present in apparently aged specimens of *luridus* could cause this species to be mistaken for *albothorax*.

Aedes luteolateralis (Theobald), figs. 4, 10

Culex luteolateralis Theobald, 1901, *Mon. Cul.* **2**: 71.

Banksinella luteolateralis Edwards, 1915, *Bull. ent. Res.* **5**: 274.

Aedes luteolateralis: Edwards, 1941, *Mosq. Ethiop. Reg.* **3**: 205.

A species very similar to *lineatopennis* in general appearance but clearly differentiated from all species in southern Africa by the combination of an almost entirely pale radial stem and R1 vein, a dark R4+5 and armed hind claws.

FEMALE. *Head and thorax*: pale scales of vertex and scutum a bright golden-yellow; proboscis frequently pale below in middle; pleural scale patches poorly developed; antepronotum and postpronotum largely bare; postspiracular scales absent; subspiracular scales consisting of a small patch of narrow yellow scales; mesepisternal and mesepimeral patches consisting of 5–15 broad creamy scales; lower mesepimeral seta present. *Abdomen*: terga with well-developed pale yellow basal bands occupying about one-third length of segments 2–6; lateral pale areas confined to pointed basal patches; terga without apical pale line. *Legs*: hind tibia with pale apical spot; hind tarsal unguis unidentate. *Wings*: (fig. 4) with pale yellow scaling as follows: costal fringe at apex; subcosta; radial stem and R1 entirely, except for short length at apex; radial sector, R2+3, R2, R3, entirely; a few scattered scales on R4+5; stem of media and M1+2 entirely, basal half of M1, basal third of M2; cubitus entirely; a short length of M3+4 at about halfway between mediocubital crossvein and wing margin.

MALE. (fig. 10). Palpus shorter relative to proboscis than in other species; second palpal segment less hairy; peg-like setae of gonocoxite densely packed like *circumluteolus*; apex of gonostylar claw rather blunt. Proboscis 1,8 mm. Palpal shaft 1,6 mm. Second segment 0,6 mm.

DISTRIBUTION. Material was examined from the following localities. **SOUTH AFRICA**: Natal; Ndumu, Josini, St Lucia, Durban, Sunwich Port, Port Shepstone. *Cape Province*; Coffee Bay. Specimens not seen: listed in the Cuthbertson Collection from **RHODESIA** with no locality given.

TYPE DATA. ♀, *Culex luteolateralis*. Locality; Durban, **SOUTH AFRICA**. British Museum (Natural History).

BIONOMICS. Probably restricted to the eastern and largely coastal lowlands. Collections at Port Shepstone showed it to be numerically predominant there to *lineatopennis*. It was collected biting man in coastal forest during daylight.

Aedes aurovenatus Worth, fig. 5

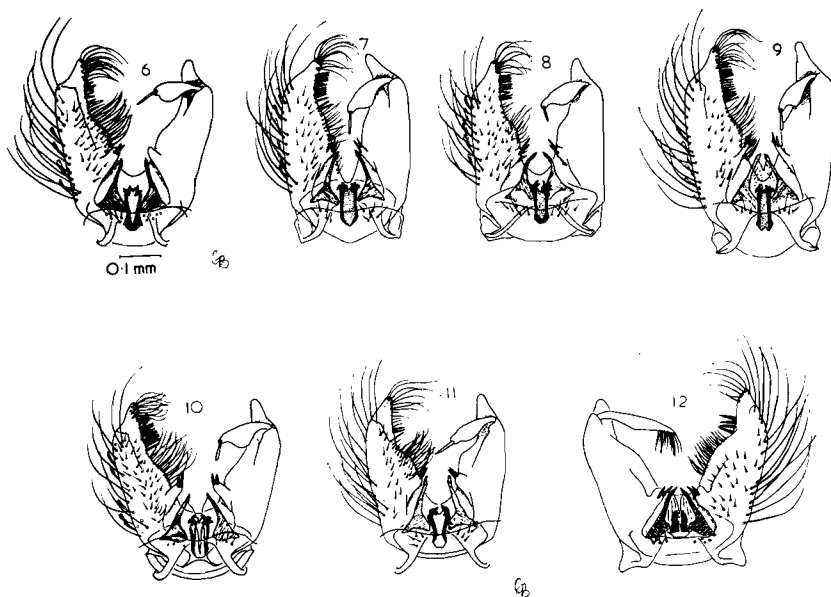
Aedes aurovenatus Worth, 1960, *J. ent. Soc. sth. Afr.* **23**: 312.

The only species lacking the distinctive pale stripe on the lateral border of scutum. The hind tarsal claws are simple. The male and immature stages are unknown. Worth described the female as follows. "*Head*: pale scales of vertex light yellow. Proboscis black. Tori brown. *Thorax*: uniformly covered with narrow pale golden scales,

not forming stripes; integument black. A few sternopleural scales; mesepimeral scale patch lacking. *Abdomen*: tergites with broad basal band of pale scales separated by an interruption from basal lateral spots of similar scales. Sternites mostly dark-scaled, but with a sparse scattering of pale scales. *Legs*: dark. *Wings*: (fig. 5) the pale yellow scaling of the wings is the most unique feature of this species, giving it its name. Distal third of costa pale-scaled; proximal two-thirds dark-scaled. Subcosta with scattered pale scales. Vein 1 pale-scaled almost to tip. Vein 2 with scattered pale scales on shaft, not fork. Vein 3 entirely pale-scaled. Vein 4 with scattered pale scales on shaft; upper branch of fork pale-scaled except at base; lower branch of fork entirely pale-scaled. Vein 5 pale-scaled throughout; including upper branch of fork. Vein 6 pale-scaled throughout. Fringe dark."

TYPE DATA. Holotype, ♀. Locality; Ndumu, SOUTH AFRICA. South African Institute for Medical Research, Johannesburg.

DISTRIBUTION. No further specimens beyond the four females collected by Worth at Ndumu in Natal have been found.



Figs 6-12. ♂ terminalia of *Neomelaniconion* species, with localities. 6. *Aedes lineatopennis* (Ludlow); Newington. 7. *A. luridus* spec. nov.; Bethulie. 8. *A. circumluteolus* (Theobald); Ndumu. 9. *A. unidentatus* spec. nov.; Olifantsvlei. 10. *A. luteolateralis* (Theobald); Durban. 11. *A. albothorax* (Theobald); Lumbo. 12. *A. palpalis* (Newstead); Congo.

Aedes albothorax (Theobald), fig. 11

Banksinella luteolateralis* vars. *albothorax* and *pallida Theobald, 1907, *Mon. Cul.* 4: 470.

Aedes albothorax: Edwards, 1941, *Mosq. Ethiop. Reg.* 3: 205.

A small species with the pale scales of the vertex and scutum greyish white instead of the usual yellow.

FEMALE. *Head*: proboscis pale yellow on middle third or more; scales of vertex white. *Thorax*: integument dark brown; scales of lateral scutal band and anterior quarter of scutum white; those of central part of scutum pale yellow, mixed with a few white; dorsocentral setae pale yellow, poorly developed; acrostichal setae not evident; anteprenotum bare; postpronotum lightly sprinkled with largely dark scales; postspiracular area bare of scales; subspiracular patch consisting of broad white scales; mesepisternal and mesepimeral patches poorly developed, consisting of 6-12 broad white scales; lower mesepimeral seta present. *Abdomen*: terga with whitish basal bands extending caudally to about half of segment, caudal margin emarginate; baso-lateral pale patches present; sterna largely dark, sometimes with baso-lateral white spots. *Legs*: hind femur pale on basal half; hind tibia pale below along entire length, broadening into apical spot; tarsal unguis of fore and midlegs equal, each unguis unidentate; hind tarsal unguis simple. *Wings*: dark with creamy white scaling as follows: subcosta; radial stem from base to base of radial sector, with scattered pale scales sometimes extending slightly onto R1; cubitus on basal three-fourths; short length at base of anal vein; scales on radial sector, R2+3, R2, R3, stem of media, and M1+2 sometimes somewhat palish, but not creamy white. Wing 3.0 mm. Proboscis 1.5 mm. Palpus 0.32 mm.

MALE. Similar to female. Palpus more hairy than other species on second segment and shaft which is hairy on about distal third. *Genitalia*: (fig. 11) gonocoxite with few peg-like setae rather similar to *lineatopennis* but basal part of gonocoxite broader while narrower apically; thus gonocoxite has markedly concave inner margin just beyond middle. Proboscis 2.2 mm. Palpal shaft 1.7 mm. Palpal second segment 1.0 mm.

DISTRIBUTION. Only material examined was from Lumbo (7 ♂, 6 ♀) on the northern MOÇAMBIQUE coast which is extra-limital to southern Africa as here defined, but it seems likely that it would occur also in southern Moçambique. Reported tentatively by Muspratt (1955) from the Transvaal and Orange Free State in SOUTH AFRICA. Two female specimens labelled as *albothorax* from Brandfort (Orange Free State) were examined and although both have pale yellow or whitish scutal bands they have definite pale scaling on radial sector, R2+3 and stem of media and narrow scales in the subspiracular patch so they are probably pale specimens of *lineatopennis*. One specimen has simple hind claws and the hind tarsi of the other are missing.

TYPE DATA. Types, ♀♀, *albothorax* and *pallida*, Locality; Inkutu, GAMBIA. British Museum (Natural History).

BIONOMICS AND DISEASE RELATIONSHIPS. Reported by Haddow (1960) to be found in forest and plantations at ground level during the day in Uganda. Kokernot *et al.* (1957, 1960) reported the isolation of Middelburg and Wesselsbron viruses from pools of mosquitoes collected in the Karroo region of South Africa and containing *lineatopennis* and a second specimen which is closely related to or identical with *albothorax*. As suggested above this species may have been *luridus*.

Aedes palpalis (Newstead), fig. 12

Neomelaniconion palpalis Newstead, 1907, *Ann. trop. Med.* **1**: 31.

Banksinella palpalis Carter, 1913, *Ann. trop. Med.* **7**: 581. Edwards, 1915, *Bull. ent. Res.* **5**: 274 and 1936, *Proc. R. ent. Soc.* **5**: 51.

Aedes palpalis: Edwards, 1941, *Mosq. Ethiop. Reg.* **3**: 209.

This species is distinguished by the absence of basal tergal bands and the largely dark wing. The gonostylus of the male is also completely different from the other species in Southern Africa.

FEMALE. *Head*: proboscis dark; vertex with exceptionally narrow median stripe of pale yellow scales, black lateral patch larger than usual. *Thorax*: integument pale brown; lateral scutal band pale yellow to almost whitish, unusually narrow, not broad as described by Edwards (1941); scales at scutal angles also pale; central part of scutum dark; prescutellar scales pale; anteprenotum, postprenotum and postspiracular area bare or with a few pale scales; subspiracular scales broad, white; similar scales in large mesepisternal and mesepimeral patches; lower mesepimeral seta present. *Abdomen*: terga without basal bands; baso-lateral pale patches present, visible from above on segments 6 and 7. *Legs*: hind femur pale on basal half and on apical half below; hind tibia with pale apical spot; all legs extensively pale behind; tarsal unguis of all legs armed. *Wing*: dark, except for short length at base of radial stem, not reaching base of radial sector. Wing 3,8 mm. Proboscis 2,2 mm. Palpus 0,4 mm.

MALE. *Genitalia*: (fig. 12) peg-like setae broad on basal half with sharp-pointed apex; gonostylus with lower edge nearly straight and with a large clump of setae on apical third surrounding gonostylar claw.

MATERIAL EXAMINED. Described from four females from Keyberg, Elizabethville (Lumbumbashi), CONGO and from one slide of male terminalia, from Stanleyville Province, CONGO.

DISTRIBUTION. Reported as var. *maculicosta* from Inhaca Island off Lourenço Marques, MOÇAMBIQUE from three larvae, since lost (Pereira, 1958). Although the larva of the variety is of uncertain identity that of *pallialis* is quite distinct (Hopkins, 1952), and for this reason this species is tentatively included in the fauna of Southern Africa.

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